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IS 1375 (1981): Black lead pencil [CHD 14: Printing, Inks, Stationary and Allied Products]



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Indian Standard

**SPECIFICATION FOR
BLACK LEAD PENCILS**

(*First Revision*)

First Reprint APRIL 1991

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR BLACK LEAD PENCILS

(First Revision)

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(Continued from page 1)

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Indian Standard

SPECIFICATION FOR BLACK LEAD PENCILS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 December 1981, after the draft finalized by the Pencils Sectional Committee had been approved by the Consumer Products and Medical Instruments Division Council.

0.2 This standard was first published in 1959 and is being revised to include additional grades and also to incorporate certain changes in the requirements.

0.3 This standard contains clauses which call for agreement between the purchaser and the supplier and which permit the purchaser to use his option for selection to suit his requirements. The relevant clauses are 3.1, 5.1, 7.1 and 7.2.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.5 This standard is intended chiefly to cover the technical provisions relating to black lead pencils, and it does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This standard covers the requirements for the following four types of pencils:

- a) Drawing pencils,

*Rules for rounding off numerical values (revised).

- b) Carpenter's pencils,
- c) Stenographer's and Reporter's pencils, and
- d) Pencils for general writing.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Black Lead Pencil — A pencil in which the slip, made basically of graphite and clay, is fixed in a wooden casing.

2.1.1 Drawing Pencil — A black lead pencil, in different grades, intended for drawing purposes.

2.1.2 Carpenter's Pencil — A black lead pencil used by carpenters for marking on wood.

2.1.3 Stenographer's and Reporter's Pencil — A black lead pencil used by stenographers and reporters for writing in shorthand.

2.1.4 General Writing Pencil — A black lead pencil used for general purposes.

3. GRADES

3.1 Drawing pencils shall be supplied in the following grades, as specified by the purchaser:

6B; 5B; 4B; 3B; 2B; B; HB; H; 2H; 3H; 4H; 5H; and 6H.

NOTE — B denotes softness and darkness of pencil and H denotes the hardness of pencil. For example, pencil of grade 6B is the softest, darkest pencil and pencil of grade 6H is the hardest, lightest pencil (see 6.5 and 6.7).

3.2 Pencils for carpenters and for stenographers and reporters shall generally be of grade HB only.

3.3 Pencils for general writing shall be supplied in the following grades:

Hard — H, 2H;

Medium — HB; and

Soft — B, 2B.

4. MATERIAL AND WORKMANSHIP

4.1 Slip — The slip shall be in one piece, of uniform grading, free from grittiness and so basically made of graphite and clay as to produce smooth,

even and uniform writing. It shall be sufficiently strong to withstand sharpening by a sharp knife or standard pencil sharpener and shall not break on mending or writing.

4.2 Casing — The casing shall be made from pencil slats conforming to IS: 3034-1975*. It shall be readily cut with an ordinary pocket knife with a reasonably sharp blade. When sharpened with a standard pencil sharpener, the wood shall take a smooth and even finish. Both halves of the wood casing shall be securely glued together throughout their length. The casing shall enclose the slip in a neat, secure manner, in such a way that the slip is centered. The warpage in 80 percent of the sample shall not exceed 0.5 mm, and in the remaining 20 percent of the sample, the warpage shall not exceed 1.0 mm.

4.3 The workmanship shall conform to the best trade practice.

5. SHAPES AND DIMENSIONS

5.1 Shapes — Carpenter's pencils shall be oval in section; Stenographer's and reporter's pencils shall be round, and the section of all other categories of pencils shall be round or hexagonal, as specified by the purchaser.

5.2 Dimensions

5.2.1 The length of the pencils shall be 177 ± 3 mm.

5.2.2 The diameter of pencils, other than carpenter's pencils, shall be between 7.5 and 8.0 mm for varnished or lacquered pencils and between 7.0 and 7.6 mm for unvarnished and unlacquered pencils. In the case of hexagonal pencils, the diameter shall be taken as the distance between any two opposite corners.

5.2.3 The cross-section of the carpenter's pencils shall be oval with the ends of the major axes trimmed straight. The dimensions of the cross-sections of carpenter's pencils shall be as indicated in either Fig. 1A or Fig. 1B.

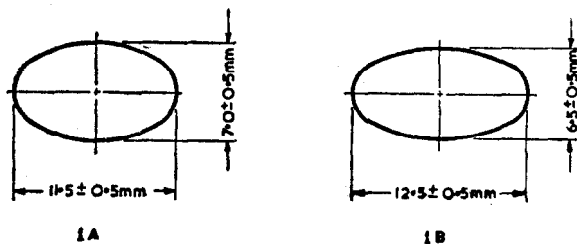


FIG. 1 CROSS-SECTION OF CARPENTER'S PENCILS

*Specification for pencil slats (first revision).

Pencils in one carton shall be of the same dimension.

5.2.4 The diameter of slips used in the manufacture of pencils, other than carpenter's pencils, shall be as under:

<i>Pencils</i>	<i>Diameter of Slip mm</i>
a) Drawing pencils, Grades 6H, 5H, 4H, 3H 2H, H and HB	1.90 to 2.30
b) Drawing pencils, Grades 2B, 3B and 4B	2.10 to 3.20
c) Drawing pencils, Grades 5B and 6B	3.50 to 3.60
d) Stenographer's and reporter's pencil	2.10 to 3.00
e) General writing pencil, Grades 2H, H, HB	1.90 to 2.30
f) General writing pencil, Grades B, 2B	2.10 to 3.20

5.2.4.1 The slips of carpenter's pencils shall be rectangular and of the following dimensions:

Width	4.4 to 5.0 mm
Thickness	2.0 to 2.5 mm

6. TESTS

6.1 Uniformity of Slip — This test is intended to check the continuity of slips and their uniformity of manufacture.

6.1.1 The electrical resistance of the slip shall be measured with any suitable instrument. The coefficient of variation of the resistance, when calculated by taking a class range of 5 ohms, shall not exceed 20 percent. The method of calculation is described in Appendix A.

6.2 Gluing and Warpage of Wood Casing — Finished pencils shall be kept for 48 h in a desiccator filled with water (*see* IS : 1070-1977*). The casing shall not separate. The warpage at the test shall be recorded (*see* 4.2).

6.3 Diameter of Slip — The slip shall be taken carefully out of the casing with a knife. The diameter of the slip shall be measured.

6.4 Strength of Slip — When tested by the method described in Appendix B, the transverse strength of the slip of pencils, other than carpenter's and drawing pencils of Grades 4H, 5H and 6H, shall be not less than 2.05 kg.

*Specification for water for general laboratory use (*second revision*).

6.4.1 In the case of carpenter's pencils, when the flat side of the slip is placed on the supporting edges, the strength of the slip shall be not less than 4.10 kg.

6.4.2 In the case of drawing pencils of Grades 4H, 5H and 6H, the strength of the slip shall be not less than 2.95 kg.

6.5 Wear of Slip — When tested by the method prescribed in Appendix C, the wear of the slip shall be as under:

<i>Type and Grade of Pencils</i>	<i>Wear of Slip, Max, mm/line</i>
a) Drawing pencils, Grades 6H, 5H and 4H	0.4
b) Drawing pencils, Grades 3H, 2H, H and HB	0.5
c) Drawing pencils, Grades B, 2B, 3B, 4B, 5B and 6B	0.6
d) Pencils for general writing, Grades 2H, H and HB	0.5
e) Pencils for general writing, Grades B and 2B	0.6
f) Carpenter's pencils	0.4
g) Stenographer's and reporter's pencils	0.5

6.6 Friction of Slip — When determined by the method specified in Appendix D, the friction of the slip shall be not more than 0.20 for all types of pencils.

6.7 Blackness of Pencil Marking — When tested by the method described in Appendix E, the blackness as measured from the reflectance values of the markings for the different grades, shall be as under:

<i>Type and Grade of Pencil</i>	<i>Blackness Index (Percent Reflectance)</i>
Pencils for general writing, hard grade	71±2
Pencils for general writing, medium grade	70±2
Pencils for general writing, soft grade	66±2
Carpenter's pencils	70±3
Stenographer's and reporter's pencils	68±3
Drawing pencils, Grade 6H	77±1
Drawing pencils, Grade 5H	75±1

<i>Type and Grade of Pencil</i>	<i>Blackness Index (Percent Reflectance)</i>
Drawing pencils, Grade 4H	74±1
Drawing pencils, Grade 3H	73±1
Drawing pencils, Grade 2H	71±1
Drawing pencils, Grade H	69±1
Drawing pencils, Grade HB	68±1
Drawing pencils, Grade B	66±1
Drawing pencils, Grade 2B	65±1
Drawing pencils, Grade 3B	63±1
Drawing pencils, Grade 4B	62±1
Drawing pencils, Grade 5B	60±1
Drawing pencils, Grade 6B	59±1

6.8 Chemical Inertness of Pencil Markings — When a paper marked with pencil lines is dipped in hydrogen peroxide, it shall not be affected by the latter.

6.9 The lacquer over the pencils shall be non-toxic.

6.10 Slide of Slip — The pencil shall be so mended that about 3 mm of the slip protrudes out of the wooden casing. The other end of the pencil shall show the slip end clearly and no lacquer or paint shall be present on the end. A load of 50 N shall be applied vertically on the wooden casing, while the protruding end of the slip rests on a glass sheet with the pencil in vertical position. The slip shall not slide in the pencil casing.

7. SAMPLING

7.1 Sampling procedure shall be a subject of agreement between the bulk buyers and the supplier.

7.2 Sealed Samples — If in order to illustrate or specify the general appearance, grades, shapes and dimensions a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects. The custody of the sealed sample shall be a matter of prior agreement between the purchaser and the supplier.

8. MARKING AND PACKING

8.1 Each pencil shall be marked with:

- a) the name and trade-mark of the manufacturer or the supplier,
- b) grade. and
- c) other indications which may be specified by the purchaser.

8.1.1 Pencils may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. Presence of this mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control during production. This system which is devised and supervised by ISI and operated by the producer has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to that standard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8.2 Twelve pencils of the same grade and type shall be pasted with a paper band, bearing the name or trade-mark of the manufacturer, type and grade of pencils. Twelve such packets shall be packed in a cardboard box. Each such box shall be marked to indicate the type, quantity and grade of pencils contained therein.

APPENDIX A

(Clause 6.1.1)

UNIFORMITY OF SLIP

A-1. PROCEDURE

A-1.1 For this test, 100 pencils selected at random from a given lot shall be taken. The ends of the pencils shall be cleaned with sand paper and the electrical resistance of each slip shall be measured with a multi-range ohm-meter. The values of the resistance obtained shall be recorded. From the values obtained, the arithmetical mean value of the resistance and the coefficient of variation could be calculated. The method described here for the calculation of the arithmetical mean and the coefficient of variation

would result in considerable saving in labour, as compared to their computation from individual measurements.

A-1.2 In this method, the pencils shall be grouped in different classes according to the values of the resistance obtained. The width of the class (W) shall be taken as 5 ohms. The mid-value of each class is called the class mark. In Table 1, the class range, and the class marks are given in col 1 and 2, respectively. Col 3 gives the frequency (f) or the number of pencils falling in each class.

TABLE 1 CALCULATION OF STANDARD DEVIATION AND COEFFICIENT OF VARIATION

CLASS RANGE ohms	CLASS MARKS W	NO. OF PENCILS f	CLASS DISTANCE d	MOMENT $f \times d$	2ND MOMENT $f \times d^2$
(1)	(2)	(3)	(4)	(5)	(6)
Below 5.0	2.5	0	-3	0	0
5.1-10.0	7.5	2	-2	-4	8
10.1-15.0	12.5	10	-1	-10	10
15.1-20.0	17.5	70	0	-14	0
20.1-25.0	22.5	13	+1	+13	13
25.1-30.0	27.5	5	+2	+10	20
30.1-35.0	32.5	0	+3	0	0
				+23	
				+9	51

A-1.3 The method of computation involves the assumption that the members grouped in each class actually were at the mid-point of their class. This assumption may not be strictly correct, but the individual discrepancies usually balance out, so that the net error is unimportant in practice.

A-1.4 Provisional mean ($\bar{r}$) of the resistance values could be judged by inspection of the distribution of pencils falling in different class ranges. It is seen from Table 1 that 70 percent of the pencils fall in the class range having the class marks of 17.5 ohms and hence the provisional mean value may be taken as 17.5 ohms.

A-1.5 Take the class range giving the provisional mean as the origin. Classes having higher resistances may be marked + (positive) and those having lower resistance may be marked - (negative). The distances (d) of each

class from the origin are indicated in col 4. The moments ($f \times d$) about the origin are given in col 5. Col 6 gives the second moments ($f \times d^2$). The average resistance (R) is given by:

$$R = \text{Provisional resistance } (r) + \left\{ \frac{\Sigma (f \times d)}{f} \times W \right\} \text{ ohms}$$

$$= 17.5 + \frac{9}{100} \times 5 = 17.95 \text{ ohms}$$

The standard deviation (σ) is given by:

$$\sigma = W \left\{ \frac{\Sigma f \cdot d^2}{\Sigma f} - \left(\frac{\Sigma f \cdot d}{\Sigma f} \right)^2 \right\}^{\frac{1}{2}}$$

$$= 5 \left\{ \frac{51}{100} - \left(\frac{9}{100} \right)^2 \right\}^{\frac{1}{2}} = 5 \times \frac{70.8}{100} = 3.540$$

$$\text{Coefficient of variation, percent} = \frac{\text{Standard deviation}}{\text{Mean}} \times 100 = \frac{3.540}{17.95} \times 100 = 19.7$$

APPENDIX B

(Clause 6.4)

DETERMINATION OF TRANSVERSE STRENGTH OF PENCIL SLIP

B-1. APPARATUS

B-1.1 The apparatus for this test consists of an arrangement (see Fig. 2) to load the pencil slip gradually. The slip is supported on two smooth knife edges, 12.7 mm apart, and loaded in the centre.

B-2. PROCEDURE

B-2.1 The balancing load L shall be so positioned that it balances the container C . The slip under test shall then be placed on the knife edges perpendicular to them. Lead shots shall be added gradually to the container

C, till the slip breaks. Four times the weight of the lead shots which the slip under test was able to bear gives the value of the strength of the slip.

NOTE — As the diameters of the pencils vary from one grade to another and from one manufacturer to another, the fibre stress (f) which gives the strength of the slip independent of the diameter may be calculated with the formula given below:

$$f = \frac{M}{I} \times h$$

where

I = moment of inertia of the area of cross-section about the neutral axis,

M = bending moment, and

h = distance of the farthest fibre from the neutral axis.

and

$$M = \frac{Wt \times l}{4} = \frac{Wt \times 1.27}{4}$$

where

Wt = load in g at which the slip breaks,

l = distance between the knife edges.

For slips of circular cross-section

$$I = \frac{\pi d^4}{64}$$

where

d = diameter of the slips in cm, and

$$h = \frac{d}{2}$$

for slips of rectangular cross-section

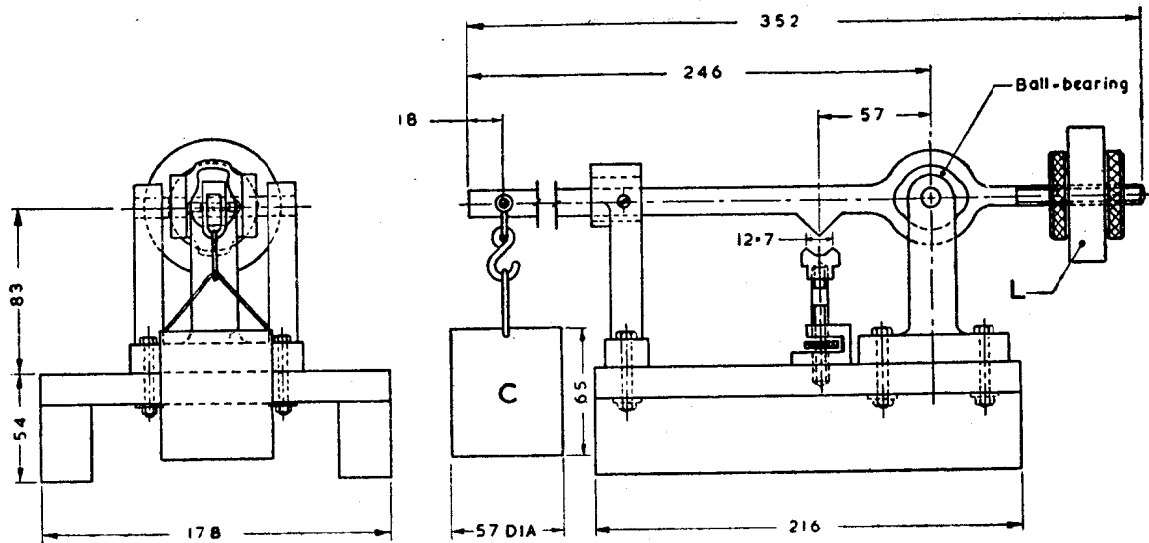
$$I = \frac{bt^3}{12}$$

where

b = breadth

t = thickness of the slip, and

$$h = \frac{t}{2}$$



All dimensions in millimetres.

FIG. 2 TRANSVERSE TEST MACHINE

APPENDIX C

(Clause 6.5)

DETERMINATION OF WEAR OF PENCIL SLIP

C-1. APPARATUS

C-1.1 The apparatus for this test consists of a travelling microscope body or any other convenient arrangement, where the microscope is replaced by a pencil holder (see Fig. 3). A 3/0 Grade sand paper shall be fixed on the flat top surface of a wooden or any other suitable platform with the help of clips. The platform shall be fixed either to the table or to the travelling microscope body with a suitable arrangement. The load on the pencil, including the weight of the holder, shall be 575 ± 3 g.

C-1.2 The pencil slip holder (see Fig. 4) shall have markings from 0 to 80 mm. The socket in which the holder moves shall have 40 markings, each at a distance of 39/40 mm. A groove shall be made in the holder and a screw fixed in the socket, so that the holder does not rotate in the socket but moves only in vertical direction.

C-2. PROCEDURE

C-2.1 The slip under test shall be cut square to its length and a piece of suitable length shall be fixed in the holder. In the case of carpenter's pencil slip, it shall be so fixed that the lines are drawn in the direction of the maximum cross-section of the slip. The holder shall then be slid into its socket and the weight placed on it. A few lines shall be marked on a separate sand paper placed on the platform to make the writing end of the slip flat. The holder shall then be taken to the extreme position and the reading noted down. A line, 12 cm long, shall then be drawn slowly. By shifting the holder by 1.5 mm, another line shall be drawn in the opposite direction. In this way, after drawing four lines, the holder shall be taken to the starting position and the reading of the holder shall be noted down. The difference in the two readings shall give the wear of the pencil for four lines, each 12 cm long. Four more lines shall be drawn and the mean of the two values shall give the wear of the pencil slip.

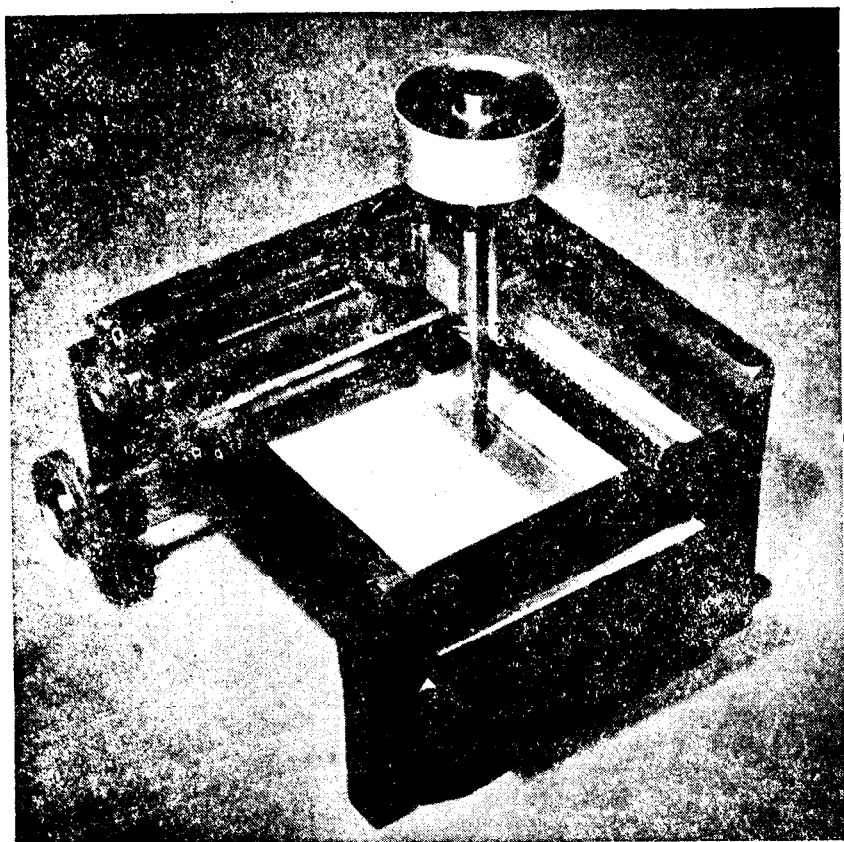
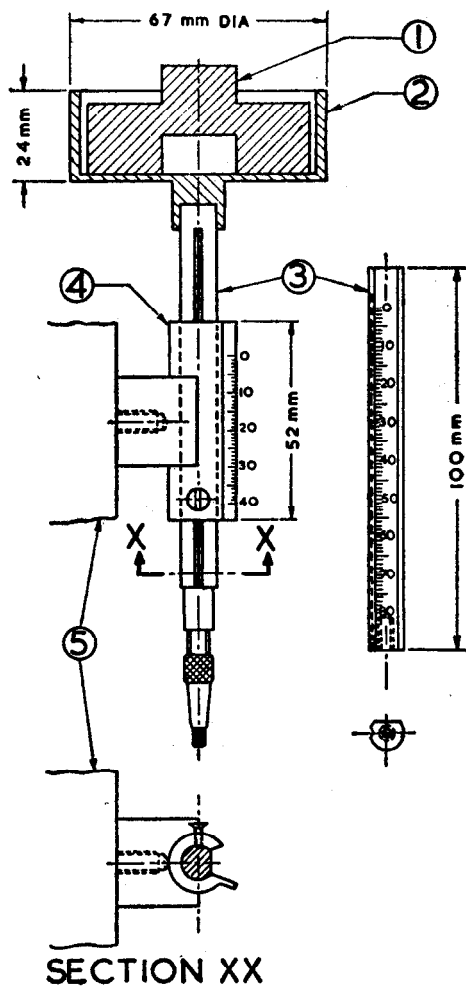


FIG. 3 APPARATUS FOR DETERMINING WEAR OF PENCIL SLIP



Legend :

1. Weight 2. Container 3. Slip Holder 4. Vernier 5. Travelling microscope body.

FIG. 4 SLIP HOLDER ASSEMBLY

APPENDIX D

(Clause 6.6)

DETERMINATION OF FRICTION OF PENCIL SLIP

D-1. APPARATUS

D-1.1 The apparatus for carrying out this test shall consist of a trolley, 635 mm long and 127 mm wide (see Fig. 5). A Whatman drawing paper of the size of the trolley shall be fixed on it. The trolley shall move on two rails, 122 cm long, at a speed of about 69 mm per second. The trolley shall be connected by means of a string to the rotating pulley of an electric motor.

D-1.2 Three pencil holders shall be fixed to a triangular stand such that the distance between any two pencil holders as also the height of the stand shall be 50.8 mm. The total weight, including the weight of the holders and stand on the three pencil slips, shall be 640 ± 3 g. The load shall be distributed equally on the three slips.

D-1.3 A string shall be attached to the pencil stand and the other end connected to a pointer and weight arrangement, so that the force experienced by the stand is measured. The pointer readings shall be calibrated as follows:

The distance between the wooden stand and the torque meter should be kept constant. The thread connecting the pencil and the lower end of the pointer shall be disconnected from the pencil stand and replaced by a longer thread which can pass over both the pulleys and through a hole in the wooden stand. Weights shall be attached to this end of the thread and the pointer readings shall be noted down. A graph of the pointer readings and the weight is drawn and may be used to convert the pointer readings to weight in grams.

D-2. PROCEDURE

D-2.1 Three pieces from the same slip shall be cut square to their length and fixed in the holders. The upper surface of the stand shall be horizontal and 50.8 mm from the ends of the slips.

D-2.2 The Whatman paper shall be fixed to the top of the trolley and the trolley shall be kept on the extreme position on the rails towards the pointer scale. The pencil stand shall be kept on the other end of the paper. The trolley shall then be pulled. The pencil stand will be dragged along with the trolley due to friction. This frictional force shall be balanced by the pointer and weight arrangement.

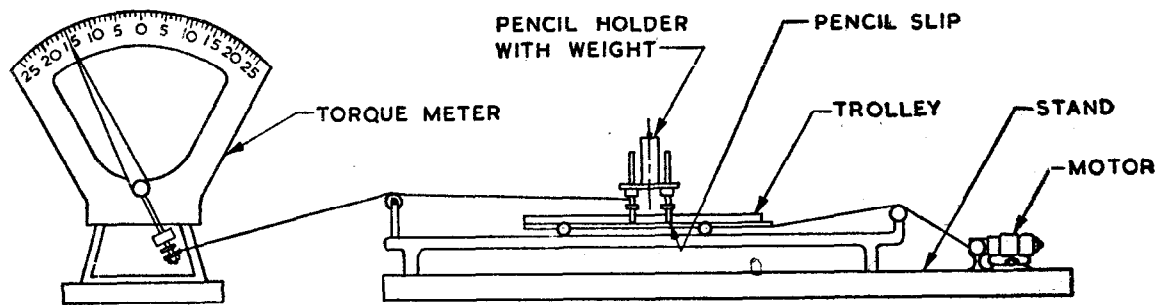


FIG. 5 APPARATUS FOR MEASUREMENT OF PENCIL SLIP FRICTION

D-2.3. The coefficient of friction shall be calculated as:

$$\frac{A}{B}$$

where

A = friction force, and

B = total load on the pencil slips.

APPENDIX E

(Clause 6.7)

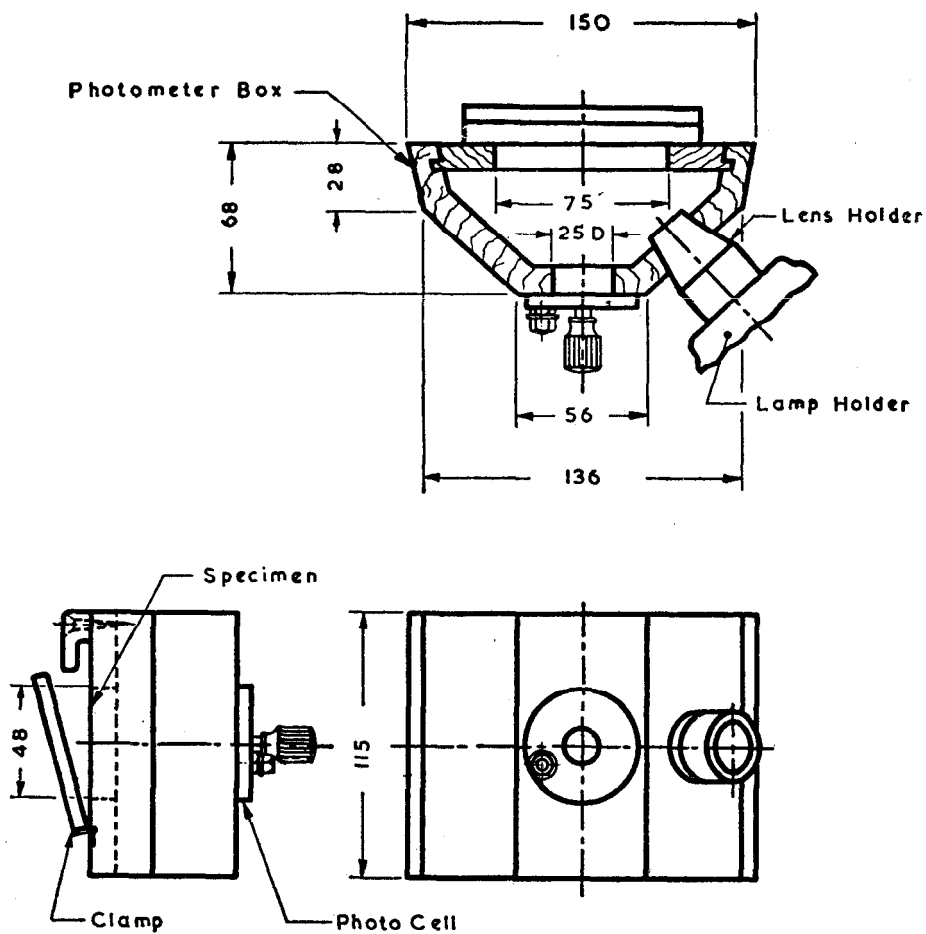
DETERMINATION OF BLACKNESS OF PENCIL MARKINGS

E-1. APPARATUS

E-1.1 Marking of Pencil Lines — The apparatus shall be similar to the one used in Appendix B. Instead of the sand paper, a Whatman drawing paper shall be used. The reflectance value of this paper shall be 79 ± 2 .

E-1.2 Measurement of Blackness of Pencil Markings — The apparatus shall consist of a box where light shall be incident on the pencil marking at an angle of 45° and the reflected light in a direction perpendicular to the markings shall be received by a photocell which shall be connected to a sensitive galvanometer (see Fig. 6). The box shall be painted from inside with a white paint giving a matt surface. To the output of the photocell and in series with the circuit, a suitable opposing electromotive force shall be applied by using a dry cell and variable resistance, so that the difference in the reflectance values shall be magnified by appropriately controlling the sensitivity of the galvanometer (by using a shunt). The reflectance values shall be in the scale of zero reflectance for a perfectly black flat surface and 100 percent reflectance for a perfectly white flat surface (MgCO_3 block).

Thin metal or plastic plates of known reflectance values may also be taken. If three such plates are taken with reflectance values approximately in the range 58 to 72 and placed in the box, the galvanometer readings may be plotted against the known reflectance values. This graph, which is a straight line, may be used to convert the galvanometer readings to reflectance values.



All dimensions in millimetres.
FIG. 6 BLACKNESS INDICATOR

E-1.3 The reflectance measurements shall be made with the help of the apparatus described above or any other similar apparatus.

E-2. PROCEDURE

E-2.1 The slip shall be cut square to its length and the end made flat by drawing a few lines, first on a sand paper and then on a drawing paper. Thirty parallel lines, each of 12 cm length and spaced 1.5 mm from their centres, shall be drawn on the drawing paper.

E-2.2 The paper with the markings shall be placed in the box and reflectance readings shall be taken at three different positions of the markings. The mean value of these three readings shall be the blackness of the pencil markings.

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AMENDMENT NO. 1 MAY 1990
TO
IS 1375 : 1981 SPECIFICATION FOR BLACK LEAD
PENCILS
(*First Revision*)

[*Page 6, clause 5.2.4 (b)*] — Insert 'B' between the words ' Grades ' and ' 2 B '.

(*Page 9, clause 8.2, lines 1 and 3*) — Substitute ' Ten ' for ' Twelve '.

(*Page 12, Note, line 1*) — Substitute ' slips ' for ' pencils '.

(CHD 14)

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